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Roll No.:.....

**NATIONAL INSTITUTE OF TECHNOLOGY CALICUT**  
 Department of Mechanical Engineering  
**End Semester Examination, Nov-Dec 2011**  
**I Semester M.Tech. – Manufacturing Technology**

**ME6303 ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION**

**Time: Three hours**

**Maximum Marks: 50**

All questions carry 2 marks each, unless mentioned otherwise.

1. Five thermometers were compared with a master thermometer reading 50.1 °C eight times each with the following results. Identify the most precise, least precise, most true and least true thermometer.

Thermo meter	1	2	3	4	5	6	7	8
A	50.2	50.0	49.9	50.3	50.2	49.9	50.1	50.2
B	51.0	51.1	51.2	51.2	51.1	51.0	51.0	51.2
C	50.5	50.4	50.6	50.7	50.3	50.5	50.4	50.6
D	49.7	49.5	49.8	49.6	49.5	49.8	49.5	49.4
E	49.5	49.8	49.6	49.7	50.1	49.8	50.1	49.8

2. Explain the common sources of uncertainty in dimensional measurement.
3. A thermocouple was calibrated as follows. Determine the regression equation and predict the temperature and its uncertainty for an emf of 2200 μV.

Temperature °C	30	40	50	60	70
Emf (μV)	1165	1550	1950	2340	2730

(6 marks)

4. The mass of a car was measured five times as 1510, 1505, 1535, 1515, 1480. Its velocity was shown as 5.4 m/s in a digital speedometer of least count 0.1 m/s. Determine the kinetic energy of the car and its 90% expanded uncertainty.

(6 marks)

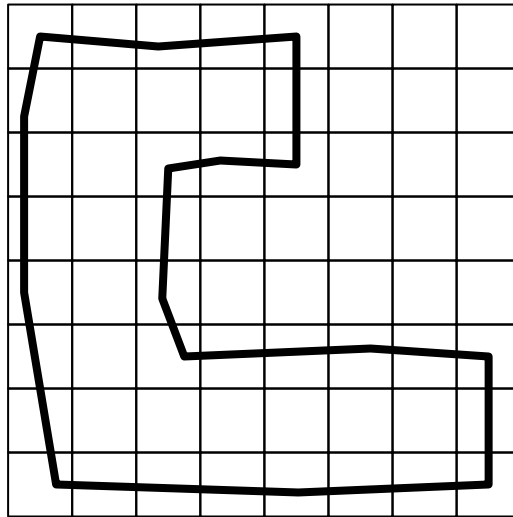
5. The inner diameter of cheap washer is specified as 8+0.1 mm. A sample from a lot was measured and found to be (8.085+/-0.02) mm. Is the sample acceptable for a guard band of a) 100% b) 50%.
6. What do you mean by structured lighting? Where is it used?
7. Sketch the image of a square with coordinates (20, 20, 100), (60, 20, 100), (60, 60, 150) and (20, 60, 150) when photographed through a camera with focal length 20 mm. The camera coordinate system has its image plane coincident with the xy plane, lens optical axis along the z axis, centre of the image plane at the origin, and centre at (0,0, focal length). The camera is in focus.
8. Identify the 4-neighbours, diagonal neighbours and 8-neighbours of P with coordinates (4,4).
9. Explain how a straight line boundary can be detected using Hough transform.
10. Explain Region growing method of segmentation.

4 3 2

11. Determine the relative smoothness for the image

3 4 1  
2 1 3

12. Explain pattern matching by correlation.
13. Determine the 4-directional chain code for the object in the image given below, starting from the bottom rightmost point.:



14. Explain how the value of cut-off affects the value of surface finish obtained during measurements.

15. Determine  $R_p$ ,  $R_v$  and  $R_t$  for the following data from a surface profilometer, neglecting slope of the mean line.

x (mm)	0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8
y ( $\mu\text{m}$ )	3	2	1	4	7	6	2	0	1	3	5	6	4	2	3

16. Determine lag 2 autocorrelation for the series 4, 7, 11, 8, 3.

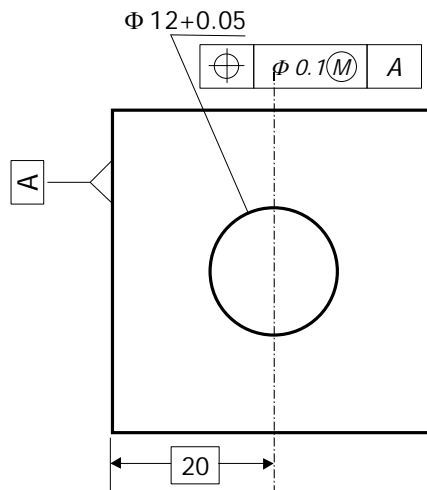
17. Explain the importance of datum precedence in manufacturing.

18. Determine the circularity error with respect to the least squares circle for the roundness measurement data:

$\theta$ °	0	30	60	90	120	150	180	210	240	270	300	330
r ( $\mu\text{m}$ )	4	5	3	2	1	6	2	3	4	7	5	3

(4 marks)

19. If the hole measures 12.02 mm and its distance from A is 20.12, is the component acceptable?



20. Sketch the symbol for Total run-out and explain how it is specified.

21. a) Give one good point about this course b) Give one suggestion which you think will best improve this course.

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